Patent Claims

1. A power generation, distribution and on-board electrical power supply system for low-emission surface navy vessels of various classes and sizes, in the form of an equipment segment, having at least one cruise propulsion system, for example an electrical steerable propeller propulsion system, which can be supplied with electrical power from a DC network, and having at least one additional propulsion system, for example a waterjet propulsion system which can be switched on when required and can be supplied with electrical power from an AC network, in which case the DC network and the AC network are configured in such a manner as to allow power to be transferred in both directions between them.

2. The equipment segment as claimed in claim 1,
characterized in that
the DC network has at least one fuel cell module for generation of electrical power, in particular a fuel cell module which at least partially consumes reformer hydrogen.

3. The equipment segment as claimed in claim 2,
characterized in that
the fuel cell module comprises air-breathing fuel cells which are connected to one another, in particular fuel cells with different dynamics.

4. The equipment segment as claimed in one of the preceding claims,
characterized in that
the AC network has at least one synchronous generator which is driven by a gas turbine, for example a synchronous generator using HTS technology, in order to generate electrical power.

5. The equipment segment as claimed in one or more of the preceding claims,
characterized in that
the DC network is a 1 kV to 15 kV network.

6. The equipment segment as claimed in one or more of the preceding claims,
characterized in that
the AC network is a 1 kV to 15 kV/50 Hz or 60 Hz network.

7. The equipment segment as claimed in one or more of the preceding claims,
characterized in that
the DC network and the AC network can jointly supply electrical power to the on-board network in the vessel as required.

8. The equipment segment as claimed in one or more of the preceding claims,
characterized by
a DC intermediate circuit for coupling the on-board network to the DC and/or to the AC network.

9. The equipment segment as claimed in one or more of the preceding claims,
characterized in that
the DC network supplies weapon and electronic systems with electrical power, including high-energy pulse or laser weapons.

10. The equipment segment as claimed in one or more of the preceding claims,
characterized in that
a plurality of fuel cell modules are arranged distributed in different sections or

safety zones, which are compartmentalized from one another in the navy vessel, and form a fail-safe network.

11. An equipment segment, in particular as claimed in one or more of the preceding claims,
characterized in that
the electrical network which is formed in the navy vessel has current limiting appliances which are in the form of HTS (high-temperature superconductor) current limiters and/or semiconductor switches, and by means of which the reaction of voltage dips in the event of short circuits, including network elements which are not affected, is restricted to a time interval in the region of a few milliseconds, in particular is limited to < 1 ms, and voltage dips such as these can thus be restricted to the respectively affected network element.

12. The electrical network as claimed in claim 11, having current limiting appliances, each of which has an HTS current limiter and a semiconductor switch and/or a circuit breaker, by means of which it is possible to protect in particular energy sources in the form of electrical power generation units and/or energy stores.

13. The equipment segment as claimed in claim 11 or 12,
characterized in that
the HTS current limiters are combined with secondary protective devices which act on the circuit breakers.

14. The equipment segment as claimed in one of claims 11 to 13,
characterized in that
the electrical network is in the form of a hierarchical network with current/time grading, in whose network couplings and/or connecting lines the current limiting appliances are arranged.

15. The equipment segment as claimed in one of claims 11 to 14,
characterized in that

the current limiting appliances are arranged such that current selectivity can be achieved by means of them in conjunction with the network configuration.

16. The equipment segment as claimed in one of claims 11 to 15,
characterized in that
the electrical network in the navy vessel is in the form of a hierarchical network with as little interconnection as possible or with reaction-free interconnection.

17. The equipment segment as claimed in claim 16, in which the reaction-free interconnection is provided by diode-decoupled feeding of DC switching systems or DC loads from two different vessel protection sections.

18. The equipment segment as claimed in one or more of claims 11 to 17,
characterized in that
the electrical network that is formed can be switched from a normal state, in which it is in the form of an interconnected electrical network, to a special state, in which it is in the form of a hierarchical network and the effectiveness of the current limiting devices is ensured.

19. The equipment segment as claimed in one or more of claims 11 to 18, whose individual switching devices have a communication device by means of which contact can be made with a higher-level switch, which trips without any time delay, in the event of failure of the switching device.

20. The equipment segment as claimed in one or more of claims 11 to 19, whose automation and control device has an on-time diagnosis unit with a high computation speed, which preferably operates on a self-learning basis, using elements of fuzzy logic or of a neural network.

21. The equipment segment as claimed in claim 20, in which a sensor or signaling unit is provided at every potential fault location, by means of which an appliance state which is associated with the respective fault location or a physical variable which is associated with the respective fault location can be detected and can be passed to the on-time diagnosis unit for the automation and control device.

22. The equipment segment as claimed in claim 21, in which the sensor or signaling units have supplies which are independent of their fault locations.

23. The equipment segment as claimed in claim 21 or 22, in which the connection between the on-time diagnosis unit for the automation and control device and the sensor or signaling units is provided by means of wire-based elements, for example control cables or bus cables in the form of copper lines or glass-fiber lines.

24. The equipment segment as claimed in one or more of claims 21 to 23, having back-up sensors which detect without the use of wires and transmit without the use of wires, with decentralized repeaters being installed in each vessel protection section.

25. The equipment segment as claimed in one or more of the preceding claims, in which PEM or HT fuel cells are provided as the electrical power generation units, by means of which direct current can be supplied to a main network in the form of a DC medium-voltage network.

26. The equipment segment as claimed in one or more of the preceding claims, in which batteries, solid-state storage devices, such as magnetic storage devices and capacitors and/or

rotating storage devices, are provided as energy stores and are preferably arranged in an on-board network intermediate circuit.

27. The equipment segment as claimed in one or more of the preceding claims, characterized in that the equipment segment has network couplings and/or network connecting lines, in each of which there is an HTS current limiter, preferably with an associated series-connected circuit breaker.

28. The equipment segment as claimed in one or more of the preceding claims,
characterized in that
the equipment segment has HTS current limiters with a superconductor composed of YbaCuO compounds, which is designed using thin-film technology and uses liquid nitrogen as the cryogenic liquid.

29. The equipment segment as claimed in one or more of the preceding claims, having outgoers in which semiconductor switches are arranged, preferably with an associated series-connected circuit breaker.

30. The equipment segment as claimed in one or more of the preceding claims,
characterized in that
the equipment segment has a main on-board network with outgoers which connect the on-board network intermediate circuits and have semiconductor switches.

31. The equipment segment as claimed in one or more of the preceding claims, in whose on-board network main groups associated load outgoers and semiconductor switches are arranged.

32. The equipment segment as claimed in one or more of the preceding claims, in which energy sources in the form of electrical power generation units or energy stores can be protected by means of semiconductor switches, in particular high-speed semiconductor switches.

33. The equipment segment as claimed in one or more of the preceding claims, having an electrical network whose semiconductor switches are in the form of IGCT switching elements (integrated gate

commutated thyristors), GTO (gate turn-off thyristors), IGBT (insulated gate bipolar transistors) or MOS transistors.

34. The equipment segment as claimed in claim 33, in which switching elements of the semiconductor switches which are in the form of IGCTs are protected by means of snubber circuits.

35. The equipment segment as claimed in one or more of the preceding claims,
characterized in that
the equipment segment is in the form of a standard equipment segment for navy vessels of various size, with size matching being provided in the form of network reduction or enlargement.

36. The equipment segment as claimed in one or more of the preceding claims,
characterized in that
POD propulsion systems are used as the cruise propulsion systems.

37. The equipment segment as claimed in one or more of claims 1 to 35,
characterized in that
electrical in-board motors are used as the cruise propulsion systems.